INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

OBSTACLE AVOIDING ROBOT DESIGNING USING AVR PROGRAMMING

Ayush Sabat*, Govinda K.
*B.Tech Student of Electronics & Communication, VIT University, Vellore (T.N) India

ABSTRACT

The obstacle avoiding robots are a great boon to the society because of their versatility, and easy maneuvering capability. These are advanced robots which have the capability to detect obstacles through sensors and move without colliding. The objective of the project to make mobile robots as the target application and problems that will be covered include : how to make (teams of) wheeled ground robots avoid collisions while reaching target locations, by using the AVR programmed microcontroller. This paper treats the navigation problem of mobile robots to avoid obstacles according to vision information. In present method, first detection of obstacles which exist in front of a mobile is done by robot by calculating the optical flow. Then, based on the area of detection, the optimal trajectory for a robot is decided. The sensor data for supporting a vision system has been used. In order to find the optimal trajectory, the distance between a mobile robot and obstacle evaluating a function is calculated. The microcontroller on the board programmed with AVR can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators.

Key words: Remotely operated, robot,, obstacle avoidance , AVR programming, microcontroller, sensor..

INTRODUCTION

There have been many accounts of user-configurable automated devices and even automata resembling animals and humans, designed primarily as entertainment since ages. A robot(1) is a modern day invention, a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry. Robots can be autonomous or semi-autonomous and range from humanoids. By mimicking a lifelike appearance or automating movements, a robot may convey a sense of intelligence or thought of its own. The evolution robots is synchronised with the development of Science and Technology, be it in the field of Electronics, Computer Science , Nano Technology etc. Electronics evolved into the driving force of development with the advent of the first electronic autonomous robots created by William Grey Walter in Bristol, England in 1948. The first digital and programmable robot was invented by George Devol in 1954 and was named the Unimate. Obstacle avoidance method for robots is modern concept, where the robots are programmed to sense the obstacle by using different programmes like AVR or Adriano etc. To overcome the presence of obstacles or forbidden regions that restrict the movement of the robot and determine an optional path that will is the motto of the project.

*Corresponding Author
Email:

REVIEW OF LITERATURE:

Autonomous obstacle avoidance technology is the best way to embody the feature of robot strong intelligence in intelligent robot navigation system. In order to solve the problem of autonomous obstacle avoidance of mobile robot, an intelligent model is used adopting multi-sensor data fusion technology and obstacle avoidance algorithm based on fuzzy control. Its perceptual system is composed of ultrasonic sensors to detect the surrounding environment from different angles, enhancing the reliability of the system on the based of redundant data between sensors, and expanding the performance of individual sensors with its complementary data, a machine-vision based obstacle avoidance system for robot system by using single camera is proposed, it could accomplished an obstacle avoidance and path planning.[1]. In this project our robot senses any obstacle in its path, avoids it and resumes its running. It involves the pre-computation of an obstacle-free path which a controller guides the robot. Autonomous obstacle avoidance technology is the best way to embody the feature of robot strong intelligence in intelligent robot navigation system. The robot can avoid obstacles with a better security path to solve the problems of mobile robot intelligent obstacle avoidance system. The design of mobile avoidance obstacle system has a good navigation effect because of its advanced characteristics of adaptability, stability and robustness[2].

Mobile robot has been a major role to the application in military, industrial and agricultural purposes. Mobile robot should navigate through desire route and avoid the obstacle within the path. Many researcher come with the solution by using the various type of control and instrumentation system. The complexity of mobile robot system can make the system cost intensive and high risk. The combination GPS and sonar will determine the position and obstacle avoidance for the mobile robot. Mobile robot should navigate according to waypoint that preset to the GPS module and sonar sensor detects the obstacle during mobile robot navigation by triggering the sonar sensor in sequence by using commanded loop daisy chaining application method. Mobile robot can navigate through desired waypoint and at the same time apply the obstacle avoidance rules[3].

The common set of procedures provided by most of indoor mobile robots consists of Mapping Building, Autolocalization, and Navigation (Path Planning and Obstacle Avoidance). Considering that real indoor environments are commonly dynamic where known obstacles rules[4].

A mobile robot system, capable of performing various tasks for the physically disabled, has been developed. To avoid collision with unexpected obstacles, the mobile robot uses ultrasonic range finders for detection and mapping. The obstacle avoidance strategy used for this robot is described. Since this strategy depends heavily on the performance of the ultrasonic range finders, these sensors and the effect of their limitations on the obstacle avoidance algorithm are discussed in detail rules[5].

AVR is a modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996. AVR microcontrollers can be termed as a mini computer with all peripherals on the chip. A typical AVR microcontroller can contain peripherals like RAM, EEPROM, Flash memory, Input-Output (I/O) pins, Analog to Digital converters, PWM channels, Timers etc. It also has a CPU for processing, but not as fast and complex as the one within a computer. These AVR microcontroller (from now on termed as μc's) is an 8-bit microcontroller and based on Reduced Instruction Set Computer (RISC) architecture. 8-bit means that the μc can transmit and receive data in a set of 8 bits. Atmel manufactures 3 variations of 8-bit microcontrollers[6]

• TinyAVR
• MegaAVR
• XmegaAVR

Dan (2009) proposed a methodology for determining optional travel path to and from existing facilities and the corresponding location of a new facility having physical flow interaction between them in different degrees translated into associated weights in the 'presence of barriers impeding the shortest flow-path involving straight-line distance.[7]

An algorithm for visual obstacle avoidance of an authonomous mobile robot was developed . The navigation algorithm is based on the optical flow information extracted from the image sequence using an embedded camera. The strategy consists in balancing the amount of left and right side flow to avoid obstacles. [8]

Based on the complementary characteristics of a web camera with structured light and sonar sensors, two different sensors have been fused to make a mobile robot explore an unknown environment with efficient mapping. Sonar sensors are used to roughly find obstacles, and the structured light vision system is used to increase the occupancy probability of obstacles detected by sonar sensors. [9]

PROPOSED METHOD
An Obstacle Avoidance Robot using has the following basic structure
Flow / circuit diagram
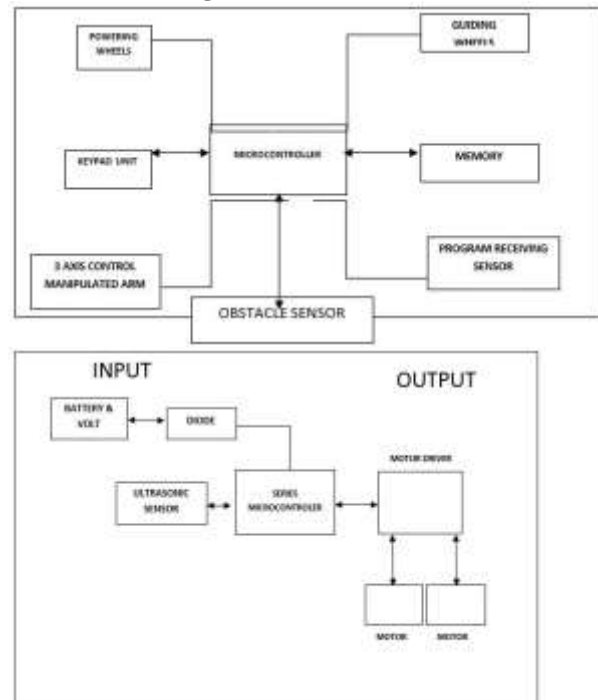
CIRCUIT DIAGRAM
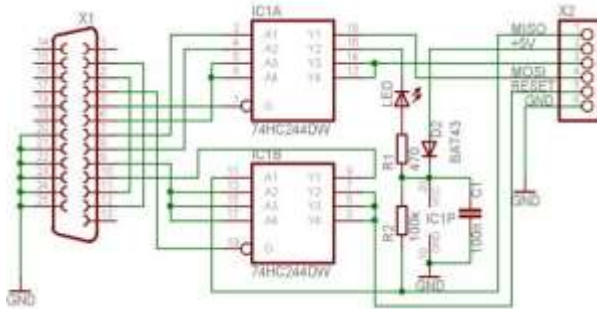
Components and functions:

- Block diagram:-
- Circuit Diagram:-
- Driver IC(1319)
- Infra Red Sensor:- two for left and right side , sensors based on reflected amplitude of the surrounding objects Non-linear and depend on the reflectance characteristics of the object surface . IR sensors are able to accurately measure distances with reduced response times. Widely used for distance measurement purposes, Surface feature detection, Barcode decoding, as a tracking system.
- IR Transmitter and reciever:- Mainly used to generate IR signal Uses timer IC555 in a stable multi-vibrator mode to generate square wave continuous pulses of 50% duty cycle of frequency 38 KHz
- Microcontroller(8051):- Single integrated circuit containing a processor core, memory, and programmable input/output peripherals Program memory in the form of NOR flash or OTPROM is also often included on chip. Microcontrollers are used in automatically controlled products and devices.
- Driver(L293D):- About: The L293D is a quadruple half H-bridge bidirectional motor driver IC Can drive current of up to 600mA with voltage range of 4.5 to 36 volts Drive small DC-Geared motors, bipolar stepper motor
- D.C Motor:- Stepper Motor, D.C Geared Motor D.C Geared Motor: Free running torque & current are ideally zero Increased load implies, increased torque, current drawn & power consumption, Power supplied by a motor is the product of output shaft's rotational velocity & torque, Can run in both directions

- Stepper motor: Used for measured rotation Can be held at a particular position of the shaft Ideal for many autonomous robots requiring higher precision
- AVR programmed Microcontroller: Based on RISC architecture 8KB of flash memory (This is where programs are stored) 512 bytes of EEPROM - "Electrically Erasable Programmable Read Only Memory", a non-volatile memory which can come in handy to store data values or initial parameters for the microcontroller. Information stored will not be destroyed in Non-volatile memory even when powered off. 1 KB internal SRAM – "Static Random Access Memory", a fast power efficient storage for data values. However SRAM is volatile, meaning data is lost on power off. 10,000 Flash/100,000 EEPROM: This means you can rewrite your program 10,000 times before your AVR dies (technically). 23 programmable Input-Output (I/O) lines and 28 pins: These I/O lines are what you use to interact with your Atmega8, and it contains 28 pins (5 pins for power lines and control Operating voltage: 4.5 - 5.5V: We can use Atmega8 within this power range.

(Actual obstacle avoiding Robot after construction)

RESULT AND DISCUSSION:

The boards can be built by hand or purchased preassembled; the software can be downloaded for free. The hardware reference designs (CAD files) are available under an open-source license. The structure of this system is using a camera and two projectors fixed on same base. When robot gets into a unknown environment, it will stop and capture an image, the system use several simple image process steps to recognize the obstacle. Obstacle avoidance robots

find numerous applications , some are described in the following:

An ultrasonic obstacle avoidance system for fire fighting robot, is a perfect example of Obstacle avoiding Robots.[10] Obstacle avoiding Robots in healthcare can have two main functions. Those which assist an individual, such as using electric wheel chair, in hospitals. Robots have developed over time from simple basic robotic assistants, such as the Handy 1 through to semi-autonomous robots, such as FRIEND which can assist the elderly and disabled with common tasks.[11] Drilling, long wall and rock breaking machines are now also available as autonomous robots. If they are equipped with obstacle avoidance system , they can autonomously execute a drilling plan on a drilling rig, moving the rig into position using GPS, set up the drill rig and drill down to specified depths. Obstacle avoiding Robots can be of immense help in military applications[12].

LIST OF AVR MICROCONTROLLER BASED PROJECTS

1. Greenhouse monitoring and controlling system using AVR microcontroller
2. Mobile controlled electrical devices using AVR microcontroller
3. Automatic room light controller with visitor counter using ATmega16
4. AVR microcontroller based Car parking monitoring system
5. AVR microcontroller based LPG gas detector
6. AVR ATmega32 based Mobile controlled robot OR Cellphone Operated Landrover Robot
7. Mobile controlled robot with camera using AVR ATmega32 OR Remote Surveillance vehicle (robot with camera)
8. AVR based Home security system using LPG sensor, IR sensor, Keypad OR Security system (IR, LPG sensor, Keypad)
9. AVR based Digital weather station Temp Humid Light OR Digital weather station
10. Greenhouse Robot using AVR microcontroller
11. Bidirectional Person counter using AVR ATmega16
12. Data Logger using AVR microcontroller including Temperature sensor, LDR & Humidity sensor)
13. Electronic Voting Machine using AVR microcontroller
14. Password Based Door Locking System using AVR microcontroller
15. AVR based Person counter and Password detector
16. Solar tracking system using AVR ATmega16
17. AVR based Temperature & Light monitoring and control
18. Temperature controller using AVR microcontroller
19. Humidity Controller using AVR microcontroller

CONCLUSION

We have tried to present the design of a small inexpensive robot, which is obstacle avoiding in functioning. With the use of the state of art in microelectronics, it was possible to Control with a wireless network interface for communication and use sensors for obstacle detection.

The advent of smaller more efficient integrated circuits, actuators, sensors, and radio communication circuit has reduced the cost of design and construction of robots. The future work on these type of robots with the use of distributed artificial intelligence and create a swarm of robots would help the society in a big way.

REFERENCES

1. *Yi Jincong ; Zhang Xiuping ; Ning Zhengyuan ; Huang Quanzhen , Intelligent Robot Obstacle Avoidance System Based on Fuzzy Control : Information Science and Engineering (ICISE), 2009 1st International Conference , Year: 2009 , Page(s): 3812 – 3815*
2. *Fujiwara, Y. ; Adachi, S. :Control system design for obstacle avoidance system using model predictive control, Control Applications, 2004. Proceedings of the 2004 IEEE International Conference on Volume: 2 ,2004 , Page(s): 1591 - 1596*
3. *Machine-vision based obstacle avoidance system for robotsystemCheng-Pei Tsai ; Chin-Tun Chuang ; Ming-Chih Lu ; Wei-Yen Wang;Shun-Feng Su ; Shyang-Lih Chang : System Science and Engineering (ICSSE), 2013 International Conference Year: 2013 , Page(s): 273 – 277*
4. *Marcelo Becker, An ultrasonic obstacle avoidance system for fire fighting robot, ieee paper obstacle, Symposium series in mechatronic, year 2006, Vol. Page(s) : 250-257.*

5. *Johann Borenstein and Yoram Koren, Obstacle A voidance with Ultrasonic Sensors, Ieee Journal of Robotics and Automation, April I988, VOL. 4, NO. 2,*

6. *www.engineersgarage.com/articles/avr-microcontrolle*

7. *Dan, Pranab. K., Obstacle Avoidance and Travel Path Determination in Facility Location Planning, Jordan Journal of Mechanical and Industrial Engineering, Vol.3, No.1, pp. 37-46, 2009.*

8. *Souhila, K. & Karin, A., Optical Flow-based Roibot Obstacle Avoidance. International Journal of Advanced Robotic Systems, Vol.4, No. 1, 2007, pp. 13-16, 2007.*

9. *Kwak, N., Kim, G.W., Ji, S.H.,Lee, B.H., A Mobile Robot Exploration Strategy with Low Cost Sonar and Tungsten-Halogen Structured Light, J Intell Robot Syst, Vol. 51, pp. 89-111, 2008.*

10. *An ultrasonic obstacle avoidance system for fire fighting robot, Tong feng ; Xu Lufeng ; Tong Daoling Intelligent Control and Automation, 2002. Proceedings of the 4th World Congress , Volume: 2 Publication Year: 2002 , Page(s): 1219 - 1222*

11. *An obstacle avoidance system for an electric wheelchair, Brown, M. ; Bradley, D. New Developments in Electric Vehicles for Disabled Persons, IEE Colloquium Year: 1995 , Page(s): 4/1 - 4/4*

12. *Vision-based obstacle avoidance system for autonomous mobile robot in outdoor environment, Ji Eun Jung ; Kil Soo Lee ; Hyung Gyu Park ; Yung Ho Koh ; Jong Il Bae ; Man Hyung Lee Control Automation and Systems (ICCAS), 2010 International Conference Year: 2010 , Page(s): 2324 – 23*